CLAIMS

1. A method of estimating the location of a device within a network of devices each of which forms a node of the network such that the device may communicate with any other node in the network either directly or indirectly via intermediate devices, the or each other device within the network with which the device may communicate directly being referred to as a neighbouring node, the method including the steps of:

obtaining information specifying the location or estimated location of one or more of the neighbouring node or nodes;

measuring the distance from the device to said one or more neighbouring nodes;

iteratively modifying an estimated location of the device, so as to reduce an error function based on the inconsistency between the estimated location of the device and the location or estimated location of the or each of the one or more neighbouring nodes, as determined from the obtained information specifying the location or estimated location of the one or more neighbouring nodes, on the one hand and the measured distance or distances from the device to the or each of the one or more neighbouring nodes on the other hand; and

periodically determining whether or not to implement a reset procedure, on the basis of whether or not certain conditions are met, by which the estimated location of the device is reset to a new location in a manner which does not seek to reduce the error function in respect of the new location relative to the immediately preceding estimated location of the device, whereby the device can avoid getting its estimated location stuck in a position corresponding to a local minimum value of the error function.

2. A method as claimed in claim 1 wherein the error function depends on the square, or the sum of the squares, of the difference or differences between the or each hypothetical distance from the device to the or each neighbouring node on the one hand and the measured distance from the device to the or each respective neighbouring node on the other hand, where the hypothetical distance from the device to a neighbouring node is the distance between the estimated position of the

device and the location or estimated location of the respective neighbouring node as obtained.

3. A method as claimed in either preceding claim wherein the network is a wireless ad-hoc network, and wherein the device communicates with the or each of its neighbouring nodes in a wireless manner.

4. A method as claimed in any preceding claim wherein the network is a mobile wireless ad-hoc network, and wherein the method includes maintaining a record of the number of neighbouring nodes, that is nodes with whom the device may communicate directly, and, in the event of detecting a change in the number of neighbouring nodes, inhibiting the reset procedure from occurring for a predetermined number of iterations.

5. A method as claimed in any preceding claim wherein the step of periodically determining whether or not to implement a reset procedure includes choosing whether or not to implement the reset procedure in a pseudo-probabilistic manner such that the pseudo-probability of implementing the reset procedure is reduced as the ratio of the number of iterations since a reset was last performed to the error function is increased, at least beyond, between or before a certain minimum and/or maximum value of this ratio.

6. A method as claimed in any preceding claim, wherein the reset procedure chooses a new location for the estimated position of the device according to the following steps:

attempting to identify the two closest nodes to the device; and

setting the new location to be the mirror image location of the current estimated position of the device reflected in the line joining the two nodes identified in the preceding step.

7. A carrier medium carrying a computer program comprising processor implementable instructions for causing a device to carry out the method of any one of the preceding claims during implementation of the instructions.

8. A device for forming a node within a network of similar devices, the device including locating means for estimating its location, the locating means including:

obtaining means for obtaining information specifying the location or estimated location of one or more neighbouring nodes;

distance measurement means for measuring the distance to said one or more neighbouring nodes; and

processing means for iteratively modifying an estimated location of the device, such as to reduce the inconsistency between the estimated location of the device and the location or estimated location of the one or more neighbouring nodes, as determined from the obtained information specifying the location or estimated location of the one or more neighbouring nodes, on the one hand and the measured distances to each of the one or more neighbouring nodes on the other hand;

said processing means further including means for determining whether or not to reset the estimated location of the device if certain conditions are met to a location determined according to a procedure which does not seek to reduce inconsistency in the current iteration, whereby the device can avoid getting its estimated location stuck in a local minimum value of inconsistency.

9. A method of obtaining positional information about individual wireless devices within a wireless ad-hoc network including a plurality of position determining devices in which each position determining device includes means for estimating the distance between itself and any other similar device forming part of the network which is within range, devices which are in range of one another hereinafter being referred to as neighbouring devices, the method including the steps of:

i) each position determining device receiving a broadcast message from each of its neighbouring devices specifying, if known, the respective neighbouring device's position or estimated position;

ii) each position determining device attempting to measure its distance from each of its neighbouring devices;

iii) each position determining device determining its actual position or an initial estimated position and storing this information;

iv) each position determining device which does not know its actual position calculating the hypothetical distance between its estimated position and the position or estimated position of each neighbouring device whose broadcast position or estimated position has been received and whose distance from the respective node has been measured in step ii);

v) each position determining device which does not know its actual position comparing the hypothetical distance calculated in step iv) with the distance measured in step ii);

vi) each position determining device which does not know its actual position, evaluating an error function which depends on the difference between the hypothetical and measured distances;

vii) each position determining device which does not know its actual position determining whether or not to implement a reset procedure on the basis of whether or not certain conditions are met, by which the estimated location of the device is reset to a new location in a manner which does not seek to reduce the error function in respect of the new location relative to the current estimated location of the device, whereby the device can avoid getting its estimated location stuck in a position corresponding to a local minimum value of the error function;

viii) each position determining device which does not know its actual position modifying its estimated position, in the event that it is determined to not implement a reset procedure in step vii), so as to reduce the error function; and

ix) each position determining device broadcasting to each other similar device in range, if known, its actual position determined in step iii) or its modified estimated position determined in step vii) or viii).